Pinewoods Wind Farm Substation and Grid Connection

Chapter 6: Land & Soil

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Contents

6.1 Introduction

6.1.1 Background and Objectives

This chapter provides an assessment of the likely effects of the proposed development (110kV substation, access track and associated works) on the land, soil and geological environment.

The assessment provides a description of the baseline environmental setting of the proposed development in terms of land, soils and geology and identifies the likely and significant effects that the construction, operation and decommissioning of the proposed development will have on them. Where required, appropriate mitigation measures to limit any identified effects to land, soils and geology are recommended. The residual effects of the proposed development post-mitigation are also assessed.

6.1.2 Development Description

In summary, the proposed development comprises the following main components:-

- 1 no. 110kV 'loop in-loop out' air-insulated switchroom (AIS) substation including control buildings, transformers and all ancillary electrical equipment; and
- All associated site development, access and reinstatement works.

Due to the sloping nature of the proposed development site, and in order to minimise the volume of material to be excavated to provide the substation footing; the design of the proposed development has incorporated a split-level approach.

The entirety of the proposed development is located within the administrative area of County Laois; while part of the overall project (Pinewoods Wind Farm) is located within County Kilkenny. Additionally, candidate quarries which may supply construction materials are also located within County Kilkenny and Carlow.

The full project description is provided at **Chapter 3** of this EIAR.

6.1.3 Statement of Authority

Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience include water and geology. We routinely complete impact assessments for land soils and geology, hydrology and hydrogeology for a large variety of project types, including wind farms and associated grid connections.

This chapter was prepared by Michael Gill and David Broderick.

Michael Gill is an Environmental Engineer with over 18 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. In addition, he has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS for the Oweninny Wind Farm, Cloncreen Wind Farm, and Carrownagown Wind Farm, and over 100 other wind farm related

projects across the country.

David Broderick is a hydrogeologist with over 13 years' experience in both the public and private sectors. Having spent two years working in the Geological Survey of Ireland, working mainly on groundwater and source protection studies, David moved into the private sector. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has also completed numerous geology and water assessments for inclusion within EIARs for a range of commercial developments. David has worked on the EIS for the Oweninny Wind Farm, Cloncreen Wind Farm, Meenbog Wind Farm, Arderroo Wind Farm and Yellow River Wind Farm, and over 80 other wind farm related projects across the country.

6.1.4 Relevant Legislation

This EIAR has been prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

Regard has also been taken of the requirements of the following legislation:-

- S.I. No. 296 of 2018 European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2001-2018;
- European Communities (Environmental Impact Assessment) Regulations 1989 to 2006;
- S.I. No. 30 of 2000 the Planning and Development Act, 2000 as amended; and
- S.I. No. 4 of 1995: The Heritage Act 1995, as amended.

6.1.5 Relevant Guidance

This chapter has been prepared in accordance with the 'EIA Directive' as amended by Directive 2014/52/EU and having regard, where relevant, to guidance contained in the following documents:-

- Environmental Protection Agency (2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Energy Development Guidelines for Planning Authorities (2006);
- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh; and,
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018); and,
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017).

6.2 Methodology

6.2.1 Desk Study

A desk study of the proposed development, and its environs, was completed in advance of undertaking the walkover survey (see below). This desk study involved collecting all relevant land and geological information for the proposed development site and the nearby permitted Pinewoods Wind Farm site. Data sources included:-

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 18 (Geology of Tipperary). Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets;
- General Soil Map of Ireland 2nd edition (www.epa.ie); and;
- Pinewoods Wind Farm EIS Land, Soils and Water chapters (Galetech, 2016).

Concerns raised by local residents and consultees in previous submissions related to the Pinewoods Wind Farm as they relate to effects on land, soil and the geological environment were also assessed in the preparation of this chapter.

6.2.2 Baseline Monitoring & Site Investigations

A walkover survey and geological mapping of the site was undertaken by HES on 20 March 2020. Trials holes were undertaken by the Applicant within the site of the proposed development on 21 January 2020.

A comprehensive site investigation, comprising trial pits and gouge cores, was previously undertaken by HES on 30 and 31 March 2015 for the then-proposed, and now permitted, Pinewoods Wind Farm.

6.2.3 Receptor Importance/Sensitivity Criteria

In addition to the utilisation of sensitivity and receptor importance criteria outline within the abovementioned EPA Guidance (EPA 2002 and 2017), this assessment, in accordance with National Roads Authority (NRA 2008) guidance, quantifies the importance of the land, soil and geology environments within the study area by applying the criteria set out in **Table 6.1**, with the impact magnitude and impact rating/significance subsequently assessed using **Table 6.2.**

Importance	Criteria	Typical Example
Very High	• Attribute has a high quality, significance or value on a regional or national scale. • Degree or extent of soil contamination is significant on a national or regional scale. • Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	• Geological feature rare on a regional or national scale (NHA). • Large existing quarry or pit. • Proven economically extractable mineral resource.
High	• Attribute has a high quality,	• Contaminated soil on site with

	significance or value on a local scale. • Degree or extent of soil contamination is significant on a local scale. • Volume of peat and/or soft organic soil underlying site is significant on a local scale.	previous heavy industrial usage. • Large recent landfill site for mixed wastes. • Geological feature of high value on a local scale (County Geological Site). • Well drained and/or high fertility soils. • Moderately sized existing quarry or pit. • Marginally economic extractable mineral resource.
Medium	• Attribute has a medium quality, significance or value on a local scale. • Degree or extent of soil contamination is moderate on a local scale. • Volume of peat and/or soft organic soil underlying site is moderate on a local scale.	• Contaminated soil on site with previous light industrial usage. • Small recent landfill site for mixed Wastes. • Moderately drained and/or moderate fertility soils. • Small existing quarry or pit. • Sub-economic extractable mineral resource.
Low	• Attribute has a low quality, significance or value on a local scale. • Degree or extent of soil contamination is minor on a local scale. • Volume of peat and/or soft organic soil underlying site is small on a local scale.	• Large historical and/or recent site for construction and demolition wastes. • Small historical and/or recent landfill site for construction and demolition wastes. • Poorly drained and/or low fertility soils. • Uneconomically extractable mineral resource.

Table 6.1: Estimation of Importance of Soil and Geology Criteria (NRA, 2008)

Impact Characteristics		Geological/Hydrological Impacts
Quality	**Significance**	

Negative only	Profound	• Widespread permanent impact on:-
		  ○ The extent or morphology of a cSAC.
		  ○ Regionally important aquifers.
		  ○ Extents of floodplains.
		• Mitigation measures are unlikely to remove such impacts.

Positive or Negative	Significant	• Local or widespread time dependent impacts on:-
		  ○ The extent or morphology of a cSAC / ecologically important area.
		  ○ A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features).
		  ○ Extent of floodplains.
		• Widespread permanent impacts on the extent or morphology of a NHA/ecologically important area,
		• Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.

Positive or Negative	Moderate	• Local time dependent impacts on:-
		  ○ The extent or morphology of a cSAC / NHA / ecologically important area.
		  ○ A minor hydrogeological feature.
		  ○ Extent of floodplains.
		• Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends

Positive, Negative or Neutral	Slight	• Local perceptible time dependent impacts not requiring mitigation.
Neutral	Imperceptible	• No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

Table 6.2: Additional Impact Characteristics

6.3 Description of the Existing Environment

6.3.1 Site Location & Description

The proposed development site, which has a total area of approximately 5.5ha, is located ~8km to the southeast of Abbeyleix in Co. Laois. The site lies within the townland of Knockardagur, Co. Laois.

This area is part of the Castlecomer Plateau, a broad upland area which straddles the boundaries between counties Laois, Carlow and Kilkenny. It is an upland area with the site elevations ranging from 225 – 250m OD (meters above Ordnance Datum). Due to the sloping nature of the proposed development site and in order to minimise the volume of material to be excavated to provide the substation footing; the design of the proposed development has incorporated a split-level approach (see **Chapter 3** for full details)

Land use at the proposed development site is agricultural grassland/pasture and ground conditions at were noted to be firm under foot. In the wider landscape, agricultural grassland/pasture remains the predominant land use; however, locally, forestry is prevalent particularly to the south east including at the site of the permitted Pinewoods Wind Farm.

The proposed development site is bordered by a hedgerow to the west, by open grassland to the east and north and a public road to the south from where the

proposed site entrance will provide access to the proposed development site.

6.3.2 Superficial Geology

6.3.2.1 Soils and Subsoils

The published soils map (www.epa.ie) for the area shows that poorly draining mineral soil (AminPD) and deep well draining mineral soil (AminDW) are the dominant soil types at the site.

A map of the local subsoil cover is illustrated in **Figure 6.1** (www.gsi.ie). This indicates that Namurian sandstone and shale tills are present on the far west of the proposed development site, with bedrock mapped close to or at the surface over the remainder of the site area.

A trial pit and dynamic probe investigation was undertaken at the proposed development site on 21January 2019 by Irish Drilling Ltd (IDL). A total of 7 no. trial pits and dynamic probes were carried out at the site. 3 no. were undertaken within the footprint of the proposed substation itself (*i.e.* TP5, TP6 and TP7) and the rest were undertaken along the route of the proposed access track to the south. A dynamic probe was undertaken at each of the trial pit locations.

A summary of the investigation findings is shown in **Table 6.3** below. The locations of the trial pits are also illustrated in **Figure 6.2** The IDL site investigation report, Trial pit logs and dynamic probe logs are included at **Volume II Annex 6.1**.

The subsoils encountered consist mainly of slightly gravelly SILT with some localised CLAY and SAND. Depth to bedrock ranged from 1.3m to 6.6m. Rock is shallowest at the north-eastern corner of the substation footprint and appears to deepen to the west / southwest which is consistent with the topography of the site.

No ground stability issues were identified by the trial pit investigation and all subsoils were found to be firm and cohesive which is generally typical of sandstone tills.

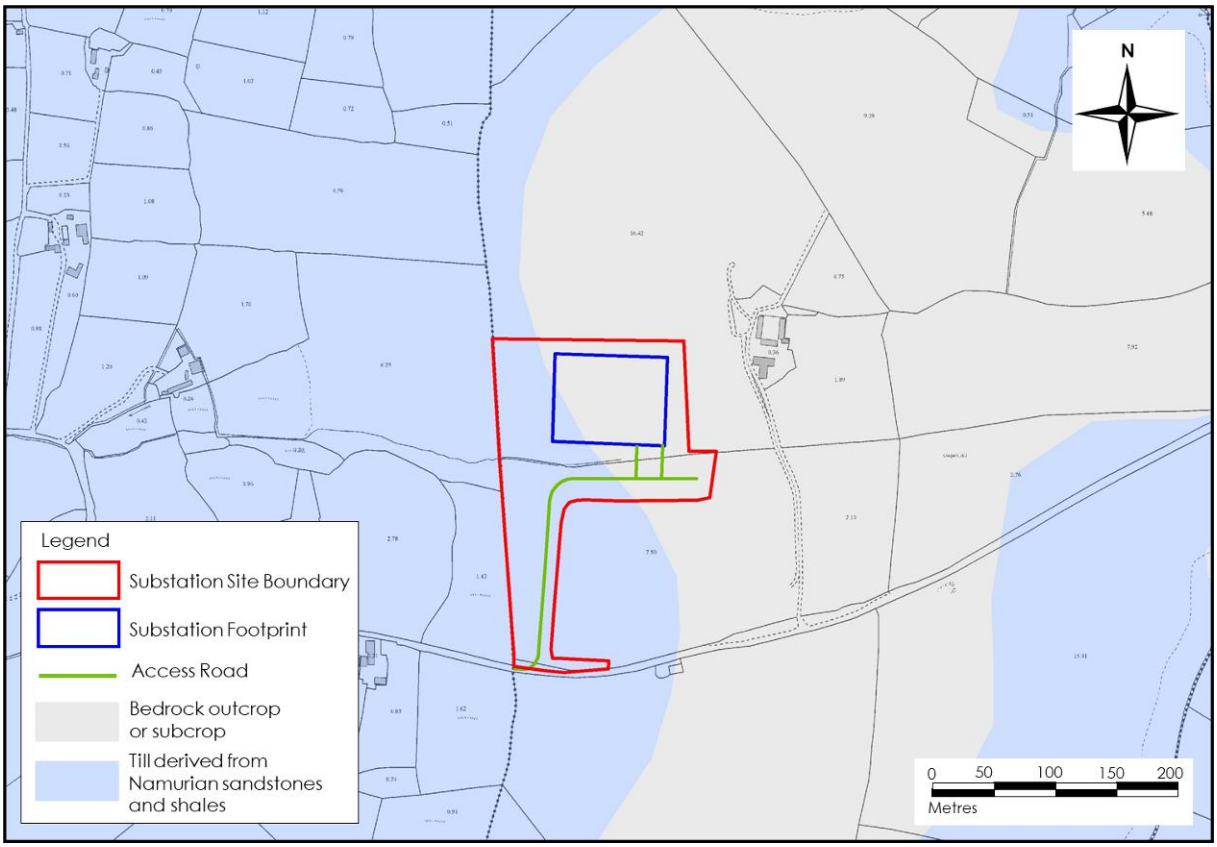

Figure 6.1: Local Subsoils Geology Mapping

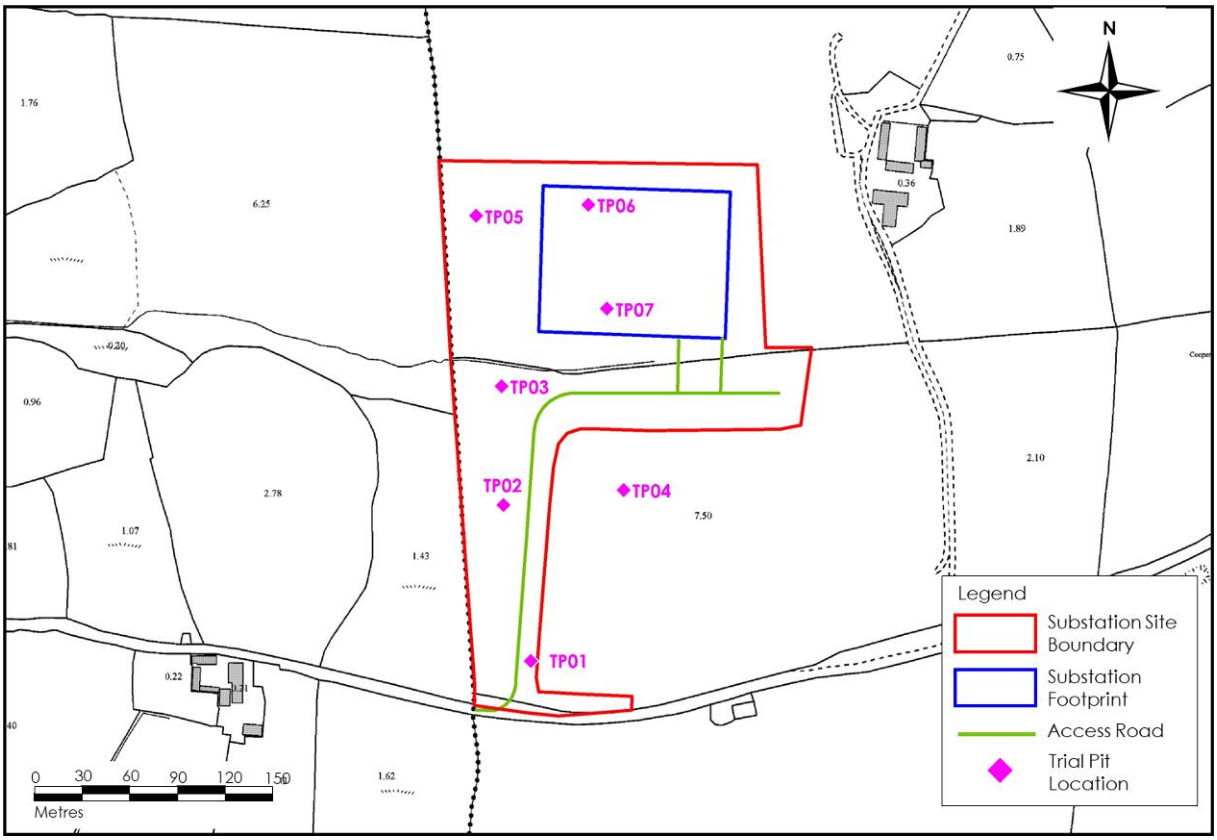

Figure 6.2: Site Investigation Map

Location	Total Depth of TP (m)	Total Depth of DP (m)	Primary Subsoil Lithology	Depth to Bedrock (m)
TP1/DP1	1.5	2.9	SILT over grey gravelly SILT	-
TP2/DP2	3	6.6	Slightly gravelly SILT and silty gravelly SAND	6.6
TP3/DP3	4	4.9	Sandy gravelly SILT	4
TP4/DP4	4	2	Slightly gravelly SILT	2.7
TP5/DP5	3.5	3.5	Slightly gravelly SILT	3.5
TP6/DP6	2.4	2.5	Silty CLAY	1.3
TP7/DP7	3	2.9	Slightly gravelly SILT	2.3

Table 6.3: Summary of Trial Pit and Dynamic Probe Investigations

6.3.3 Bedrock Geology

Based on the GSI bedrock map, the bedrock units underlying the proposed development site comprise Namurian sandstones. However, shale bedrock was encountered in all the trial pits undertaken at the site.

The upper profile of the shale bedrock was found to be generally weathered or very soft with excavation of the rock been possible with the excavator bucket.

The Castlecomer Plateau, which encompasses the proposed development site, is a broad gentle syncline (V-shaped fold) in which the rock strata generally dip towards the centre. The Plateau is then subdivided into a series of compartments by NE-SW and NW-SE trending faults. There are no mapped faults within or in the immediate vicinity of the proposed development site. A bedrock geology map of the area is illustrated in **Figure 6.3**.

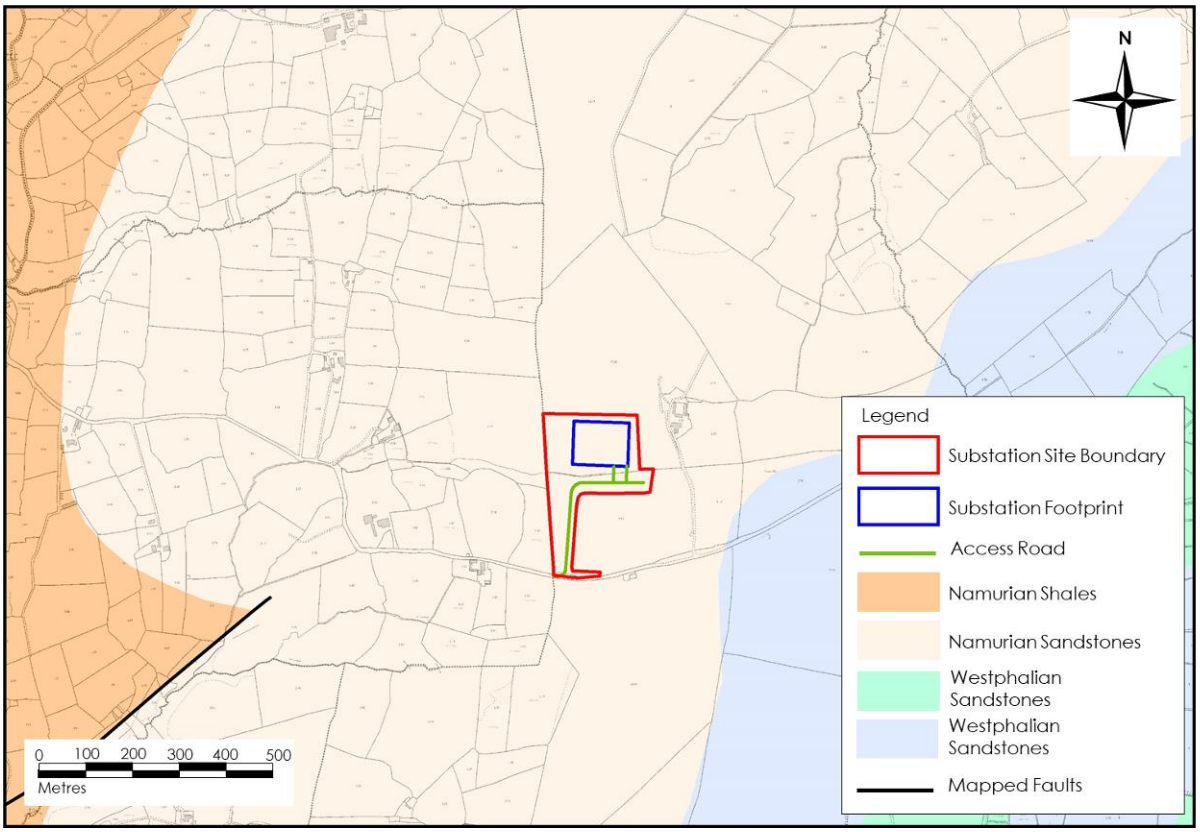

Figure 6.3: Local Bedrock Geology Mapping

6.3.4 Geological Resource Importance

The sandstone bedrock at the site could be classified as "Medium" importance. The bedrock could be used on a 'sub-economic' local scale for construction purposes; however, this bedrock has not been previously used for this purpose.

The mineral subsoil deposits at the site could be classified as "High to Medium" in terms of agricultural usage. Refer to **Table 6.1** for definition of these criteria.

6.3.5 Geological Heritage & Designated Sites

There are no GSI recorded Geological Heritage sites, mineral deposit sites or mining sites (current or historic) within the proposed development area. The proposed development is not located within any designated site. The closest geological heritage sites to the proposed development are located at The Swan, c. 4km to the east of the proposed development site.

6.4 Description of Likely Effects

6.4.1 Characteristics of the Proposed Development

The proposed development will typically involve removal of soil (where present), subsoils and bedrock to facilitate the construction of the proposed substation, access track and ancillary infrastructure. As referred to above and described in detail at **Chapter 3**, the proposed development involves a bespoke 3 step 'split level design' to reduce the volume of material to be excavated to provide the substation footing and, in turn, reduce effects on land and soil.

The overall indicative volume of subsoil excavation for the proposed development has been established as being approximately 62,000m^3. The estimated volume of

material to be re-used on site as fill or in the reinstatement/landscaping of the site 28,750m^3. Spoil reinstatement will be possible through the following methods:-

- Saving the top layer of the subsoil excavated for landscaping uses over any backfilled areas; and
- Placing the excavated subsoil along roadside berms.

It is estimated that c. 33,250m^3 of excess material (topsoil, subsoil and rock material) will arise which cannot be re-used or accommodated within the proposed development site. Where excess material comprises suitable aggregates, it is proposed to transport this material to the Pinewoods Wind Farm for use in the construction of access tracks and areas of hardstanding.

Where excess material comprises topsoil or subsoil, it is proposed, where appropriate to do so, to re-use this material for reinstatement and landscaping purposes within the Pinewoods Wind Farm site for the purposes of:-

- Resurfacing of hardstanding areas;
- Reinstatement of site entrances; and
- Trackside berms and landscaping.

Appropriate locations for the deposition of this material will be carefully selected in accordance with **Section 2.3.5** and **2.3.6** of the CEMP enclosed at **Annex 3.4** (**Volume II**); in consultation with the on-site Ecological Clerk of Works (ECoW) and Environmental Manager (EM); ensuring that, at all times, water quality/siltation mitigation measures are fully implemented in advance and that the receiving site is suitable from a ground stability perspective. Spoil will be transported to these locations where it will be placed in accordance with best-practice methods to ensure the long-term stability of the stored material.

In the event that spoil is encountered which cannot be reused either within the proposed development site or within the permitted Pinewoods Wind Farm, this material will be disposed of in an environmentally sensitive manner by a licensed waste contractor in consultation with the Planning Authority.

6.4.2 "Do Nothing" Impacts

In the event that the proposed development is not progressed, the site will continue to be used as agricultural land and there will be no alteration to the land, soil or geological environment.

6.4.3 Construction Phase

6.4.3.1 Soil, Subsoil Excavation and Bedrock Excavation

The excavation of soil, subsoil and bedrock will be required for the levelling of the site to the requisite gradient and for the installation of building foundations, concrete plinths for electrical apparatus and for the foundations of electricity strain towers. This will result in a permanent removal of soil, subsoil and bedrock at excavation locations. Estimated volumes of soil and subsoils to be relocated are discussed at **Section 6.4.1** above.

The overall impact magnitude is determined not to be significant due to the following:-

- soils and subsoil at the site can be classified as "High to Moderate" importance with the former relating to agricultural land and the latter to forestry;

- The bedrock at the site can be classified as "Medium" importance;
- The soil, subsoil and bedrock which will be removed during the construction phase will be localised to the footprint of the proposed development;
- A minimal volume of soil, subsoil and bedrock, in comparison to the total resource present in the overall landholding will be removed to allow for infrastructural work to take place; and
- No infrastructure will be constructed within or near any designated sites for the protection of geological feature such as NHAs or SACs.

The soil and subsoil excavation final effect is summarised in **Table 6.4** below.

Attribute	Description
Receptor	Soils, subsoils and bedrock
Pathway/Mechanism	Excavations and extraction
Final Effect	Negative, slight/moderate, direct, high probability, permanent effect on peat, subsoil and bedrock.

Table 6.4: Soil and Subsoil Excavation

6.4.3.2 Erosion of Exposed Soil and Subsoil

Exposure of soil and subsoils at excavation areas can increase the likelihood for soil erosion resulting in a direct physical effect on the land and soil environment. The overall effect is determined to be 'Small Adverse' due, predominately, to the small development footprint area in comparison to the overall landholding.

The soil and subsoil erosion pre-mitigation effect is summarised in **Table 6.5** below.

Attribute	Description
Receptor	Soil and subsoils
Pathway/Mechanism	Vehicle movement, surface water erosion, and wind action.
Pre-mitigation Effect	Negative, direct, slight, likely effect on soil and subsoils.

Table 6.5: Soil and Subsoil Erosion

6.4.3.3 Contamination of Soil by Leakages and Spillages and Alteration of Soil Geochemistry

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a pollution risk. The accumulation of small spills of fuels and lubricants during routine plant use can also be a significant pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks have the potential to result in significant effects (i.e. contamination of peat, subsoils and pollution of the underlying aquifer) on the geological and water environment.

The soil contamination pre-mitigation effect is summarised in **Table 6.6** below.

Attribute	Description
Receptor	Soil, subsoil and bedrock
Pathway	Soil, subsoil and bedrock pore space

Pre-mitigation Effect	Negative, direct, slight, short term, medium probability effect on soils, subsoils and bedrock.

Table 6.6: Soil and Subsoil Contamination

6.4.4 Operational Phase

Very few likely direct effects are envisaged during the operational phase of the proposed development. These may include:-

- Some construction vehicles or plant may be necessary for maintenance which could result in minor accidental leaks or spills of fuel/oil; and,
- The transformer in the substation is oil cooled. There is a risk for spills / leaks of oils from this equipment resulting in contamination of soils and groundwater.

In relation to indirect effects, a small amount of granular material may be required to maintain access tracks during operation which will place intermittent minor demand on local quarries.

6.4.5 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, decommissioning phase effects will not occur.

6.4.6 Cumulative Effects

The land and soil effect assessment concludes that significant effects are unlikely to arise predominately due to the localised and near surface nature of the construction works and the absence of likely significant effects during the operation and decommissioning phases.

Therefore, and given the absence of likely significant effects arising from the proposed development individually; there is no likelihood for significant cumulative effects, arising from the entire proposed development, with any existing, permitted or proposed development on land, soils and geology. All effects relating to the proposed development are assessed to be direct and contained within the immediate vicinity of the proposed development and it is assessed that there is no pathway for the development to act in combination with other projects.

All other existing, permitted and proposed developments (including the Pinewoods Wind Farm) in the vicinity of the proposed development have been assessed to determine their likelihood to act in combination with the proposed development; however, it is concluded that there is no likelihood for likely significant cumulative effects.

In relation to the Pinewoods Wind Farm, the residual effects of the permitted wind farm on land, soils and geology were assessed to be not significant. Due to the direct nature of the works with regard the wind farm and substation, the spread out footprint of the wind farm infrastructure and the non-significant effects of the substation (as assessed above), no significant cumulative effects on land, soils and geology will occur.

6.4.7 Assessment of Likely Health Effects

The likelihood of health effects, albeit low, arises mainly from the possibility of soil and ground contamination during construction. A development, such as the proposed, is

not a recognised source of land or soil pollution and so the likelihood for effects during the construction or operational phases are negligible.

Hydrocarbons will be used onsite during construction; however the volumes will be small and will be handled and stored in accordance with best practice mitigation measures. As a result, it is concluded that the likely residual effects associated with soil or ground contamination and subsequent health effects are negligible.

6.4.8 "Worst Case" Effects

Localised contamination of soils and subsoils during the construction phase due to fuels / oils leaks and spillages. Localised soil stability issues due to the movement and storage of peat. The "worst case" effects are not expected to be significant.

6.5 Mitigation & Monitoring

6.5.1 Construction Phase

6.5.1.1 Soil, Subsoil Excavation and Bedrock Excavation

The excavation of soil, subsoil and bedrock will have a direct effect on the geological environment and no specific mitigation measures are proposed. The excavation of materials will be completed in accordance with best practice for the management and treatment of such materials.

6.5.1.2 Erosion of Exposed Subsoils During Construction Work

Proposed Mitigation Measures:-

- Excavated soil will be side cast and stored temporarily adjacent to excavation areas for use during reinstatement and landscaping;
- Silt fences will be installed around all temporary stockpiles and excavated areas to limit movement of entrained sediment in surface water runoff;
- In order to minimise runoff during the construction phase, works will not take place during periods of intense or prolonged rainfall (to prevent increased silt laden runoff). Drainage systems, as outlined in **Chapter 7**, will be implemented to limit runoff effects during the construction phase;
- Bog mats will be used, as necessary, to support construction plant and machinery on soft ground, thus reducing the likelihood for soil and subsoil erosion and avoiding the formation of rutted areas. This will substantially reduce the likelihood for surface water ponding to occur;

6.5.1.3 Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry

The following mitigation measures are proposed:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compound at the Pinewoods Wind Farm. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around

the site by a 4x4 jeep to where plant and machinery is located. The 4x4 jeep will also be fully stocked with fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;

- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be available to deal with and accidental spillage in and outside the re-fuelling area;
- An emergency plan for the construction phase to deal with accidental spillages is contained within the Outline Construction and Environmental Management Plan (**Annex 3.4**). This emergency plan will be further developed by the contractor prior to the commencement of construction.

6.5.2 Operational Phase

Following the completion of construction activities and the reseeding of exposed soil as a result of excavations, it is assessed that due to the absence of likely soil erosion effects, no mitigation measures are required.

Oil used in transformers (and other electrical apparatus) and storage of hydrocarbons could result in leakages during the operational phase and result in effects on soil and subsoils. The transformer and any hydrocarbon storage areas will be located in a roofed concrete bund capable of holding 110% of the stored oil volume.

The electrical control buildings will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor.

6.5.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, no decommissioning phase mitigation measures are required.

6.5.4 Monitoring Measures

There is no proposed monitoring programme with respect of land and soils. However, during and post construction all excavated or raised areas (i.e. cut and fill) and reinstated/landscaped ground will be inspected for signs of erosion and instability. These inspections will be undertaken on a weekly basis during the construction phase and monthly, for a six-month period, post construction.

6.6 Residual Effects

6.6.1 Construction Phase

6.6.1.1 Soil, Subsoil Excavation and Bedrock Excavation

The importance of the soil at the site can be classified as of "High to Medium" but not designated or unique in any way. The residual effect on the land, soil and geological environment is the disturbance and relocation of c. 62,000m^3 of soil, subsoil and bedrock during construction, however, no likely significant effects on the

geological environment are likely to arise from these excavations. Therefore the residual effect is considered to be negative, imperceptible, direct, short term, low probability effect.

No significant residual effects on soils, subsoils or bedrock are assessed as likely.

6.6.1.2 Erosion of Exposed Subsoils During Construction Work

Soil and spoil can be eroded by vehicle movements, wind action and by water movement. To prevent this, all excavation works will be followed by appropriate reinstatement, landscaping and drainage control. Following implementation of these measures, the residual effects are considered to be negative, slight, direct, medium probability effect on soil, subsoils and weathered bedrock.

No significant residual effects on soils, subsoils or bedrock are assessed as likely.

6.6.1.3 Contamination of Soil by Leakages and Spillages and Alteration of Soil Geochemistry

The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the source and the receptor. The residual effect is considered to be - negative, imperceptible, direct, short term, low probability effect.

No significant residual effects on soils, subsoils or bedrock are assessed as likely.

6.6.2 Operational Phase

No significant residual effects are assessed as likely to occur during the operational phase.

6.6.3 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.8**), the proposed development will form part of the national electricity network and decommissioning of the substation is not proposed. Therefore, residual decommissioning phase effects will not occur.

6.7 Summary

Excavations will be required for site levelling and for the installation of foundations, hardstands and access tracks. This will result in a permanent removal of soil, subsoil and bedrock at excavation locations. Excavated soil and subsoil will be used for reinstatement and landscaping and where excess material arises, this will be disposed at the dedicated spoil disposal areas.

Due to geographically spread out nature of the Pinewoods Wind Farm infrastructure, the proposed development will not result in a significant cumulative effect with the wind farm development.

Furthermore, all other existing, permitted and proposed developments in the vicinity of the proposed development have been assessed to determine their likelihood to act in combination with the proposed development; however, it is concluded that there is no likelihood of significant cumulative effects.

In conclusion, this assessment has determined that the proposed development will not result in any likely significant effects on land and soil. Where effects are likely to occur, such as soil contamination and erosion, the implementation of appropriate mitigation measures will ensure that any effects are negligible and imperceptible.

Where it is not possible to implement mitigation measures, such as in respect of the direct excavation of soil and subsoil, the level of effect is considered to be slight/moderate and will not be significant.